

Docket No.: 285507US0PCT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

IN RE APPLICATION OF:

GROUP: 1784

Tadaaki KANEKO, et al.

SERIAL NO: 10/566,652

EXAMINER: LANGMAN, JONATHAN C

FILED: June 28, 2006

FOR: TANTALUM CARBIDE, METHOD FOR PRODUCING TANTALUM CARBIDE, TANTALUM CARBIDE WIRING AND TANTALUM CARBIDE ELECTRODE

**DECLARATION UNDER 37 C.F.R. § 1.132**

COMMISSIONER FOR PATENTS  
ALEXANDRIA, VIRGINIA 22313

Sir:

Now comes Satoshi TORIMI who deposes and states that:

1. I am a graduate of Graduate School of Kwansei Gakuin University and received my Master degree in the year 2008.
2. I have been employed by Toyo Tanso Co. LTD for 2 years and 9 months as an assistant researcher.
3. I have reviewed and understood the Office Action dated February 18, 2011 and I have read and understood the contents of Douglass et al. (US 3,163,563), Lopez et al (US 5,916,377) and Garg et al (US 5,126,206).
4. The following experiments were carried out by me or under my direct supervision and control.

**Experiment I**

Two Ta base materials were subjected to thermal treatments as shown in Table I below,

Table 1.

	Temp[°C]	Vacuum Pressure (Pa)	Period (hr)	C: Ta: O (mass%)
Comp. Example 1	2000, 2330*	10	2	44.25: 54.45 : 1.31
Example 1	2000	10	2	19.7: 39.7: 40.85

2300\* : the carbon penetration was conducted at 2300 °C or higher because the carbon source in Douglass was CH<sub>4</sub> and CH<sub>4</sub> was not decomposed when the temperature was not high enough, i.e. about 2300 °C.

For Comparative Example 1, carbon penetration was conducted in a condition substantially identical with the condition in Douglass where the carbon penetration was carried out without removing Ta<sub>2</sub>O<sub>5</sub> formed on the surface of the tantalum substrate. For Example 1, after Ta<sub>2</sub>O<sub>5</sub> formed on the surface of the tantalum substrate was removed, carbon penetration was carried out.

The surface SEM images of Comparative Example 1 and Example 1 are shown in Reference Drawing 1. In Example 1, a fibrous structure in which fibrous crystals are densely provided is observed whereas no fibrous crystals are observed in Comparative Example 1. This result clearly demonstrates that the crystal structure of the present invention is not obtained in Comparative Example 1. The crystal structure of Comparative Example 1 has poor hardness and poor frictional resistance because the crystals are sparsely provided. Additionally, an oxygen content at the surface of Comparative Example 1 indicates the presence of Ta<sub>2</sub>O<sub>5</sub> and shows that Ta<sub>2</sub>O<sub>5</sub> was not removed before the carbon penetration and that the purity of the tantalum carbide was low.

#### Experiment II

Two Ta base materials were subjected to thermal treatments as shown in Table 2 below.

Table 2.

	Furnace Temp[°C]	Vacuum Pressure (Pa)	Period (hr)
Comp. Example 2	1850	10	2
Example 2	2000	10	2

For Example 2, after  $Ta_2O_5$  formed on the surface of the tantalum substrate was removed, carbon penetration was carried out. The tantalum carbide obtained by the carbon penetration after the removal of  $Ta_2O_5$  has uniform thickness in depth in both TaC layer and  $TaC_2$  layer as shown in cross-sectional optical microscope images of Example 2 below. Reference Drawing 2 contains optical microscope images of (1)(a), (1)(b), (2)(a) and 2(b) taken at various areas of Example 2 and the optical microscope images of (1)(a), (1)(b), (2)(a) and 2(b) were taken at various areas of Comparative Example 2 .

To the contrary, for Comparative Example 2, carbon penetration was carried out without removing  $Ta_2O_5$  formed on the surface of the tantalum substrate. As shown in cross-sectional optical microscope images of Comparative Example 2 in Reference Drawing 2, the tantalum carbide forms uneven layers of  $Ta_2C$  throughout the surface of Comparative Example 2.

As is evident from the experimental results in Experiment I and II, the tantalum material obtained without removing  $Ta_2O_5$  formed on the surface of the tantalum substrate prior to carbon penetration does **not necessarily** form a TaC layer having fibrous crystals as in the present application. In fact, in the present Experiment I and II, the tantalum material obtained without removing  $Ta_2O_5$  formed on the surface of the tantalum substrate prior to carbon penetration did not form a TaC layer having fibrous crystals as in the present application. It is my opinion, based on the examples above and the examples of the specification, that a tantalum carbide material of the above-captioned patent application as shown in Experiment I and II should not have been foreseen based on the disclosures of the references cited.

Application No. 10/568,882  
Declaration under 37 C.F.R. 1.132

5. The undersigned petitioner declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

6. Further deponent saith not.

Suresh Coondani  
Signature

Date 6/16/2011

Customer Number

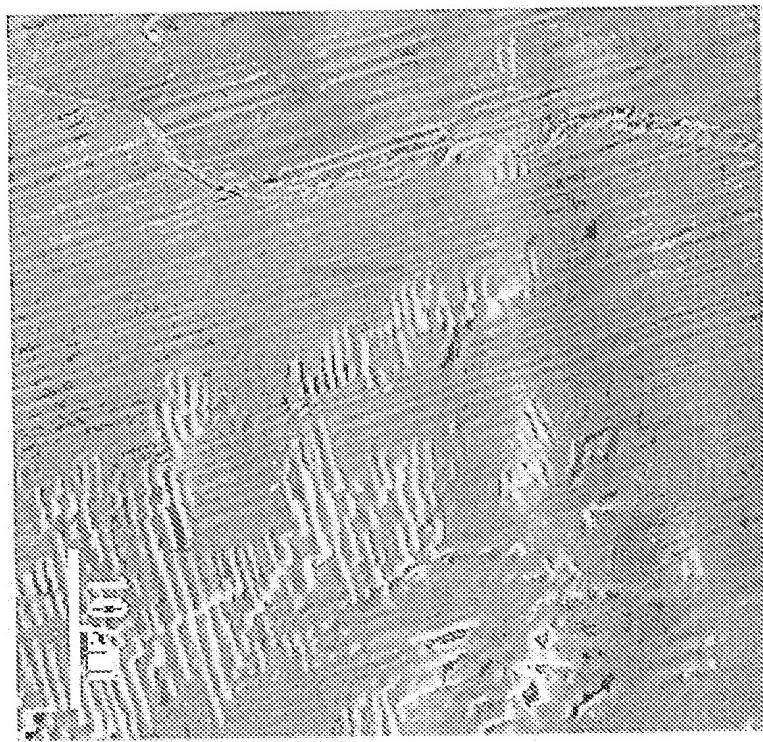
22850

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Reference drawing 1

Comparative example 1

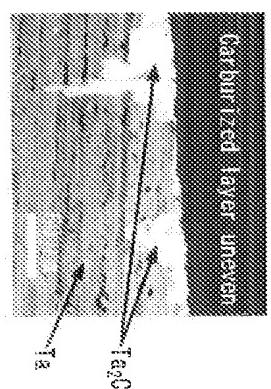
Example 1 (the present invention)



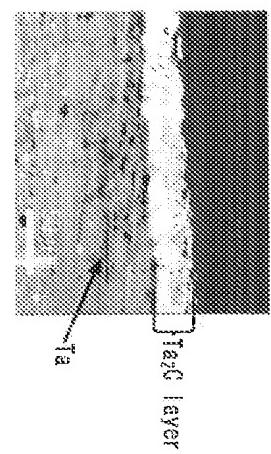
## Gross-sectional optical microscope image

Comparative example 2

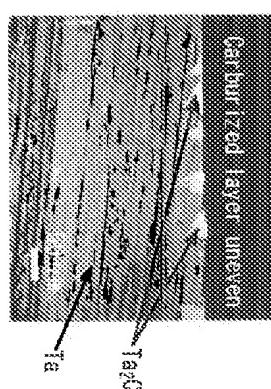
(1) (a)



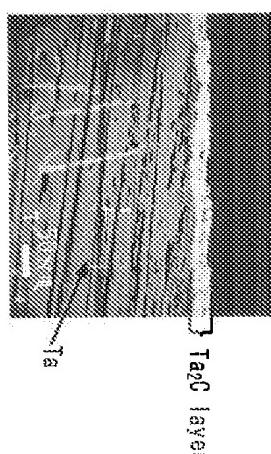
(1) (b)



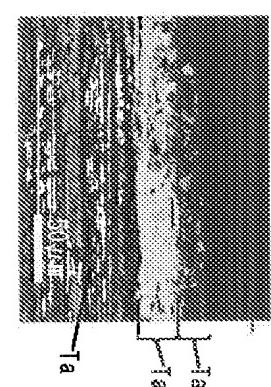
(2) (a)



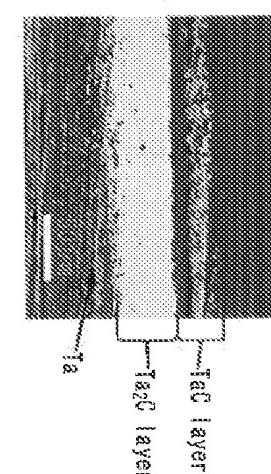
(2) (b)



(4) (a)



(4) (b)



Example 2 (the present invention)

## Surface SEM image

Comparative example 2

Example 2

